

**REMARKS**

Claims 25-41, 44-48 and 65-78 are pending in this application. Claims 25 and 44 were variously rejected under 35 U.S.C. § 112, first paragraph. Claims 25 and 44 were variously rejected under 35 U.S.C. § 112, second paragraph. Claims 25-41, 44-48 and 65-78 were variously rejected under 35 U.S.C. § 103.

**Finality**

Applicants appreciate the Examiner's withdraw of the finality of the previous Office Action.

**Rejections under 35 U.S.C. §112, first paragraph**

Claims 25 and 44 were rejected under 35 U.S.C. §112, first paragraph, as allegedly failing to comply with the written description requirement. The Examiner alleged that these claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Applicants respectfully traverse this ground for rejection.

In the Amendment filed December 2, 2003, Applicants specifically pointed out the support for the recited limitation "non-movably" in the present specification and drawings. (December 2, 2003 Amendment at 10-11.) The Examiner's only response is the following conclusory statement:

There is no support in the specification for the use of "non-movably" regarding the adaptation of the piezoelectric and electrode elements. Applicants have failed to support this limitation in the specification.

(January 4, 2004 Office Action at 9.) The Examiner failed to offer any reason as to why the places pointed out by the Applicants do not support the recited limitation “non-movably.” In order to expedite prosecution of the present application, while not admitting the correctness of the Examiner’s assertion, Applicants have replaced “non-movably” with “stationary” in claims 25 and 44. As recognized by the Examiner, the present specification and drawings show, to the skilled in the art, “stationary” electrodes. (September 3, 2003 Office Action at 2.)

In view of the foregoing, Applicants respectfully submit that the written description requirement has been met. Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejections under 35 U.S.C. § 112, first paragraph.

Rejection under 35 U.S.C. §112, second paragraph

Claims 25 and 44 were rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. According to the Examiner:

- It is unclear whether the electrodes claimed are on one substrate or are on more than one substrate.
- It is also unclear whether these electrodes are parallel or perpendicular or in another configuration.
- It is unclear as to whether the electrodes controlling electrophoretic or dielectrophoretic forces are the same electrodes as those which are controlling the piezoelectric forces.
- It is unclear whether one single generator is used to make both the electrophoretic or dielectrophoretic forces as well as the piezoelectric forces.

- It is unclear whether more than one generator is used to make the electrophoretic or dielectrophoretic forces as well as the piezoelectric forces.
- Furthermore, it is unclear as to the frequency cutoff when the AC transducer is creating a dielectrophoretic force (Hz) or whether it is creating an acoustic force (Hz).

Applicants respectfully traverse this rejection. First, Applicants are surprised that these types of issues were raised for the first time now. These claim limitations have been present in the claims from the beginning and there is no reason for the Examiner to wait until the fourth office action to raise the issue. This is clearly contradictory to the spirit of “compact prosecution” mandate from MPEP.

On the merits, it seems that the Examiner has equated breadth of a claim with indefiniteness. However, under well established precedents, breadth of a claim is not to be equated with indefiniteness. MPEP § 2173.04 *citing In re Miller*, 441 F.2d 689, 169 USPQ 597 (CCPA 1971). If the scope of the subject matter embraced by the claims is clear, and if applicants have not otherwise indicated that they intend the invention to be of a scope different from that defined in the claims, then the claims comply with 35 U.S.C. § 112, second paragraph.

The presently pending claims require the use of stationary electrode elements adapted along a portion of a chamber, when energized by a first electrical signal generator, to create at least one electrophoretic force having components normal to the traveling direction of a carrier medium on a matter in the carrier medium. So long the required force is created, the stationary electrode elements can be arranged in various ways along a portion of a chamber. The stationary electrode elements can be located on one substrate or can be located on more than one substrate. These electrodes can be parallel to each other but such an arrangement is not mandatory. The same is true for stationary electrode elements for creating at least one dielectrophoretic force and the stationary piezoelectric transducer for creating at least one acoustic force. Similarly, same or different

electrodes can be used for creating electrophoretic or dielectrophoretic force and the piezoelectric force. (See the present specification at page 39, lines 25-29 and Figure 5.) The same is also true for the voltage requirement. As taught in the present specification, signals desired for the apparatuses and methods of the present invention can be in the range of about 0 to about 15 volts, and about 0.1 Hz to about 100 kHz. (See the present specification at page 12, lines 20-28.) But these are the exemplary ranges only. The point is that so long as the stationary electrode elements and the stationary piezoelectric transducer are adapted along a portion of a chamber in a manner to create the requisite forces, the specific arrangement of the electrode elements and the piezoelectric transducer is not important.

Claims need only “reasonably apprise those skilled in the art” of their scope and be “as precise as the subject permits.” *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 231 USPQ 81, 94 (Fed. Cir. 1986), *cert. den.*, 480 U.S. 947 (1987). The Court in *Orthokinetics, Inc v. Safety Travel Chairs, Inc.*, 1 USPQ2d 1081 (Fed. Cir. 1986) held that a claim limitation requiring that a pediatric wheelchair part be “so dimensioned as to be insertable through the space between the doorframe of an automobile and one of the seats” is definite. The Court stated:

The phrase 'so dimensioned' is as accurate as the subject matter permits, automobiles being of various sizes. As long as those of ordinary skill in the art realized that the dimensions could be easily obtained, § 112, 2d ¶ requires nothing more. The patent law does not require that all possible lengths corresponding to the spaces in hundreds of different automobiles be listed in the patent, let alone that they be listed in the claims.

1 USPQ2d at 1088. In the present case, the skilled artisans would know how to arrange the stationary electrode elements and the stationary piezoelectric transducer along a portion of a chamber in a manner to create the requisite forces. The patent law does not require that all possible specific arrangements of the electrode elements and the piezoelectric transducer be listed in the patent, let alone that they be listed in the claims.

Although Applicants believe that the claims were sufficiently definite when considered in view of the specification and the understanding of those of skill in the art, Applicants have attempted to respond to the concerns of the Examiner in order to enhance clarity and to facilitate disposition of the present case. In order to expedite prosecution of the present application, while not admitting the correctness of the Examiner's assertion, Applicants have amended claims 25, 44, 65, 68, 72 and 75 to require that different electrical signal generators are used to generate the electrophoretic force/dielectrophoretic force and the acoustic force. Support for this amendment can be found in the original application and *inter alia*, at page 38, lines 10-15 indicating the generator 310 is used to generate the acoustic force, and at page 39, lines 16-24 indicating that generator 290 is used to generate the electrophoretic force; and in Figure 5.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 112, second paragraph.

Rejection under 35 U.S.C. §103

Claims 25-41, 44-48 and 65-78 were rejected under 35 U.S.C. §103 as allegedly unpatentable over Yasuda, *et al.* (U.S. Patent No. 6,216,538) in view of Becker *et al.* (U.S. Patent No. 6,294,063 and Becker, *et al.* (U.S. Patent No. 5,888,370).

Applicants respectfully traverse this rejection. The Examiner maintains that Yasuda teaches a combined use of electrophoretic and acoustic forces for field flow fractionation with carrier medium. **This is simply not true.** As discussed in the December 2, 2003 Amendment, most of the teachings of Yasuda cited by the Examiner are directed to the use of electrophoretic force or acoustic force alone, not in combination. See e.g., Yasuda at: col. 3, line 19-35 (acoustic force alone); col. 7, line 15-20 (compressible v. incompressible fluid); col. 9, line 58-63 (acoustic force alone); col. 12, line 63 (acoustic force alone). The only teachings about the use of electrophoretic force and acoustic force in combination in Yasuda are for cell fusion (Figures 10 and 11, col. 10,

line 19 through col. 11, line 24) and gel-electrophoresis (Figures 13, col. 15, line 36 through col. 16, line 28).

The use of electrophoretic force and acoustic force in combination for cell fusion and gel-electrophoresis, as taught in Yasuda, is very different from the use of electrophoretic force and acoustic force in field flow fractionation, as presently claimed. One of the limitations of the presently claimed apparatuses and methods is “a chamber having at least one inlet port and at least one outlet port, said chamber having such structural characteristics that when a carried medium is caused to travel through said chamber, the traveling velocity of said carried medium at various positions within said chamber is different” (*See e.g.*, Section a) of claims 25 and 44). Regardless whether Yasuda teaches an inlet or an outlet, cell fusion must be conducted in a closed system and there can be no traveling fluid, as shown in Figures 10-12 of Yasuda. Without a traveling fluid, there would be no traveling velocity of the carried medium, let alone different traveling velocities of the carried medium at various positions within a chamber. In gel-electrophoresis, traveling velocity of a carried medium at various positions is the same, not different.

In addition, none of the apparatuses taught in Yasuda uses both at least two electrode elements to cause at least one electrophoretic force having components normal to the traveling direction of the carrier medium on a matter in the carrier medium and at least one piezoelectric transducer to cause at least one acoustic force having components normal to the traveling direction of the carrier medium on a matter in the carrier medium. For example, in the apparatuses shown in Figure 10 of Yasuda, the electrodes 33 are used to cause cell fusion and are not used to maintain cell positions (*See* Yasuda at column 10, lines 19-45). Only acoustic force is used to maintain or change cell positions. *Id.* Similarly, the apparatuses shown in Figure 11 of Yasuda does not use both electrophoretic force and acoustic force. At column 11, lines 18-24, Yasuda teaches:

In this embodiment, ultrasonic waves are used as the means for trapping a particle as a target, and means for causing a chemical substance to act locally is used as the cell fusion means. However, the means for supplying the chemical substance for local action with this

micro-pipetting unit may be used when a cell is trapped by pipette suction, an electric field trap, an optical trap, etc (emphasis added).

This teaching shows that the cell is trapped by either acoustic force or electrophoretic force, but not both. At column 12, lines 1-3, Yasuda teaches:

Instead of using ultrasonic waves, other methods such as applying an electric field or adding a cell fusion accelerator may be used.

This teaching shows that, for the apparatuses shown in Figure 12 of Yasuda, electrophoretic force is only used for cell fusion, not for positioning the cell. For the apparatuses shown in Figure 13 of Yasuda, electrophoretic force is used to drive particle movement in the gel-electrophoresis (*See* Yasuda at column 15, line 36 through column 16, line 27). Accordingly, the electrophoretic force is in the direction of particle movement, not normal to the direction of the particle movement.

Further, the presently claimed apparatuses require that at least two stationary electrode elements be adapted along a portion of the chamber and the at least one stationary piezoelectric transducer be adapted along a portion of the chamber. Both electrode elements and the piezoelectric transducer are used to generate electrical force and acoustic force having components normal to the traveling direction of the carrier medium. The teaching of Yasuda is in complete contrast in this aspect. For example, the apparatuses shown in Figure 10 of Yasuda are used to promote cell fusion. The ultrasonic wave oscillators 31 and the acoustic lens 32 are used to trap a cell at the focal point of ultrasonic waves (*See* Yasuda at column 10, lines 26-27). In order to do that, the position of the focal point can be moved by moving a unit, including the ultrasonic wave oscillator 31 and the acoustic lens 32 by a three-dimensional manipulation unit 35. Making the ultrasonic wave oscillators 31 and the acoustic lens 32 stationary along a portion of the chamber, as required by the present claims, would render the apparatuses shown in Figure 10 of Yasuda inoperable. For the same reason, the pair of two-dimensional arrays of transducers 39, as shown in Figure 12 of Yasuda, cannot be stationary along a portion of the chamber. The apparatuses shown in Figure 13 of Yasuda are used in gel-electrophoresis. Accordingly, the electrophoretic force must be in the direction of particle movement, but cannot be normal to the direction of the particle movement.

The two Becker patents do not cure the defects of Yasuda. The skilled artisans would not be motivated to combine the cited references. The '370 patent, while teaching field flow fractionation devices and methods, uses electrophoretic force only and does not teach the use of both electrophoretic force and acoustic force in field flow fractionation. The Examiner's allegation that one skilled in art would combine with Yasuda to arrive at the presently claimed invention contradicts the Examiner's own position in restricting the original claims of the present application. In the October 22, 2002 Office Action, the Examiner made the following restriction:

I. Claims 1-24 and 51-64, drawn to Method and Apparatus for Acoustic Force Field Flow Fractionation.

II. Claims 25-50 and 65-78, drawn to Method and Apparatus for Electrophoretic and Acoustic Force Field Flow Fractionation.

Therefore, according to the Examiner, method and apparatus for flow fractionation using acoustic force alone and method and apparatus for flow fractionation using acoustic force and electrophoretic force in combination are patentably distinct inventions. The presently claimed invention is directed to method and apparatus for flow fractionation using acoustic force and electrophoretic force in combination. The '370 patent teaches field flow fractionation devices and methods using electrophoretic force alone. Therefore, according to the Examiner's own reasoning, the '370 patent, which teaches field flow fractionation devices and methods using electrophoretic force alone, patentably distinct from the presently claimed invention, which is directed to method and apparatus for flow fractionation using acoustic force and electrophoretic force in combination. As discussed above, Yasuda also does not teaching any method and apparatus for flow fractionation using acoustic force and electrophoretic force in combination. The third reference, the '063 patent, which teaches methods and apparatuses for microfluidic processing by programmably manipulating a packet, has nothing to do with field flow fractionation at all.

The Examiner tried to support the obviousness rejection by pointing out that applicants admitted that both electrophoretic and acoustic forces are taught in combination in Yasuda. It is

true that Yasuda teaches the use of electrophoretic and acoustic forces in certain embodiments. However, as discussed above, Applicants' point is that the presently claimed invention is directed to method and apparatus for flow fractionation using acoustic force and electrophoretic force in combination. The only teachings about the use of electrophoretic force and acoustic force in combination in Yasuda are for cell fusion and gel-electrophoresis. Accordingly, there are at least four structural differences between the presently claimed invention and Yasuda's teaching. First, the combined use of acoustic force and electrophoretic force is for cell fusion, which requires a closed system without traveling fluid whereas the presently claimed invention requires a traveling fluid. Second, the elements for generating the acoustic force in Yasuda must be mobile for trapping cells before cell fusion can occur whereas the presently claimed invention requires stationary piezoelectric transducer for generating the acoustic force. Third, when the combination of the acoustic force and the electrophoretic force is used for gel-electrophoresis in Yasuda, the traveling velocity of a carried medium at various positions is the same whereas the presently claimed invention requires the traveling velocity of the carried medium at various positions within the chamber is different. Fourth, for gel-electrophoresis in Yasuda, the electrophoretic force must be in the same direction as the traveling direction of the carrier medium whereas the presently claimed invention requires the electrophoretic force having components normal to the traveling direction of the carrier medium.

In response to Applicant's argument that the electrophoretic and acoustic forces taught in Yasuda are different than that presently claimed, the Examiner cited *In re Gershon*, 152, USPQ 602 (CCPA 1967) to support the obviousness rejection. According to the Examiner, the mere fact that the references relied on by the USPTO fail to evince an appreciation of the problem identified and solved by applicant is not, standing alone, conclusive evidence of the nonobviousness of the claimed subject matter. The references may suggest doing what an applicant has done even though workers in the art were ignorant of the existence of the problem.

Applicants fail to see how the holding of *In re Gershon* has any bearing on the present case. In *In re Gershon*, the holding is based on the Court's finding that the prior art clearly suggested doing what appellants have done, although an underlying explanation of exactly why this

should be done, other than to obtain the expected superior beneficial results, was not taught or suggested in the cited references. *In re Gershon* at 605. This is entirely different from the present case. In the instant case, none of the cited references teaches that modifying or combining Yasuda with the Becker patents would bring any expected superior beneficial results to the prior art devices. On the contrary, as discussed above, modifying Yasuda to arrive at the presently claimed invention, *e.g.*, by replacing the mobile electrodes with stationary piezoelectric transducer, would render the cell fusion embodiment in Yasuda, as replied upon by the Examiner, inoperable.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejections under 35 U.S.C. §103.

#### Rejections Under Double Patenting

Claim 44 was objected under 37 C.F.R. § 1.75 as allegedly being a substantial duplicate of claim 25. According to the Examiner, both claim an apparatus with a chamber having at least one inlet and outlet port, at least two electrode elements non-movably adapted along a portion of said chamber, electric signal provided by an electric signal generator and at least one piezoelectric transducer non-movably adapted along a portion of said chamber, piezoelectric signal provided by an electric signal generator.

Applicants are puzzled by this objection as claims 25 and 44 are directed to different embodiments. Claim 25 requires the use of both an electrophoretic force and an acoustic force whereas claim 44 requires the use of both an dielectrophoretic force and an acoustic force and these requirements are clearly recited in the claims. The electrophoretic force and the dielectrophoretic force are two different forces with different properties. (*See* the present specification at page 62, line 13 through page 64, line 8.)

In view of the foregoing, Accordingly, applicant respectfully requests withdrawal of these rejections.

**CONCLUSION**

Applicants believe that all issues raised in the Office Action have been properly addressed in this response. Accordingly, reconsideration and allowance of the pending claims is respectfully requested. If the Examiner feels that a telephone interview would serve to facilitate resolution of any outstanding issues, the Examiner is encouraged to contact Applicants' representative at the telephone number below.

In the unlikely event that the transmittal letter is separated from this document and the Patent Office determines that an extension and/or other relief is required, Applicants petition for any required relief including extensions of time and authorize the Assistant Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952** referencing docket no. 471842000200.

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Respectfully submitted,

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